

No. 2.— *The Systematic Position of Palaeospiza bella* Allen, with
Observations on other Fossil Birds.

By ALEXANDER WETMORE.

INTRODUCTION.

IN the year 1877 Mr. S. H. Scudder obtained near Florissant, Colorado, a slab containing the fossilized remains of a passeriform bird of small size preserved almost entire. The specimen was placed in the hands of Dr. J. A. Allen, then at the Museum of Comparative Zoölogy, for study, and was described by Allen as *Palaeospiza bella* (Bull. U. S. geol. geog. surv. terr., 3 May, 1878, 4, p. 443-444, pl. 1, fig. 1). The type was deposited for many years in the Boston Society of Natural History, but recently has been transferred to the Museum of Comparative Zoölogy, where it has been mounted in a plaque and placed on exhibition. Thus far our knowledge of *Palaeospiza* has been based on the original description and it has seemed advisable to submit the type to a second critical examination in the light of advance in knowledge in the nearly fifty years that have elapsed since its discovery. Through the kind coöperation of the authorities of the Museum of Comparative Zoölogy, the type of *Palaeospiza* was forwarded to the U. S. National Museum at Washington, where it has been compared with a large number of recent birds. The writer is deeply indebted to the Museum for the privilege of this examination.

In the original description the strata from which the type of *Palaeospiza* came were called the insect-bearing shales of Florissant, while in the list of fossil birds in the third edition of the A. O. U. Check-List, published in 1910 (p. 392), they are recorded as the Amyzon Shales. In more modern nomenclature these deposits are known as the Florissant lake beds, famous for the large numbers of beautifully preserved plants and insects that they have yielded during a period of fifty years. For details regarding the beds in question, I am indebted to a recent paper by Dr. F. H. Knowlton on the fossil plants of this region,¹ in which is given, in the introduction, a résumé of the occurrence of these deposits. Fossils in these strata are believed to have been laid down in the shallow waters of a small lake with an irregular shore line, five

¹ A Review of the Fossil Plants in the United States National Museum from the Florissant Lake Beds at Florissant, Colorado, with Descriptions of new Species and List of Type-Specimens. Proc. U. S. N. M., 24 November, 1916, 51, p. 241-297, 16 plates.

miles long and a mile wide. The preserved material is supposed to have been buried in volcanic ash, sifted over the country during repeated eruptions, and in mud and sand washed in by rains. As the Florissant beds lie isolated from other sedimentary rock, in deposits of granite, their geologic age must be determined from palaeontological evidence alone. Dr. A. C. Peale, who visited the area in 1873, and gave the first account of its geology, considered them as Pliocene, but Lesquereux, who studied the plants, at first believed them to be upper Miocene, but later, with Cope, called them lower Miocene, or Oligocene, a position assigned them in most current text-books. Further study, particularly of the plants, has indicated that Lesquereux's original assignment was correct, so that Knowlton, the most recent authority to write on the subject, states (*l.c.*, p. 244) that "While it is improbable that the final word has been said regarding the exact stratigraphic position of these beds, until conclusive evidence to the contrary has been presented the Florissant plant-bearing beds may be regarded as upper Miocene."

Though plant and insect remains occur in these beds in abundant profusion, avian fossils have remained rare. *Palaeospiza bella*, the first bird to be described from them, was followed by *Charadrius shepardianus* Cope (Bull. U. S. geol. geogr. surv. terr., 11 February, 1881, 6, p. 83), discovered by Dr. G. Hambach and named for Edwin Shepard, of Philadelphia, according to Cope "an excellent ornithologist and skillful artist." Dr. Knowlton (Proc. U. S. N. M., 1916, 51, p. 245) has called attention to the curious fact that the type of *Fontinalis pristina* Lesquereux (Rept. U. S. geol. surv. terr., 1883, 8, p. 135, pl. 21, fig. 9), named as a species of moss, is in reality a section of a feather. The A. O. U. Code seems to make no provision for such cases, but in the International Code it is stated "if, however, an organism is transferred from the vegetable to the animal kingdom, its botanical names are to be accepted in zoölogical nomenclature with their original botanical status."

The type in question must be considered as a definitely named fossil bird though there is little or no hope that a proper relationship may be assigned it.

As *Fontinalis* does not appear to be preoccupied in zoölogy, *Fontinalis pristina* must be anchored as another weathered derelict in the sad haven of *incertae sedis*, at the close of our check-list of fossils. Both genus and species will have Lesquereux as authority.

Additional fossil remains from the Florissant have been described (but not named) by Shufeldt (Proc. U. S. N. M., 15 August, 1917, 53,

p. 453-455, 2 pls.), who gave an account of two small slabs containing impressions of bird bones, secured by Prof. I. E. Cutler, of the University of Denver. In the present connection I have examined these specimens and find that they comprise two passeriform species, one represented by an impression of the pelvic and caudal region, and the other, somewhat larger, by the tarsus, foot, and tibio-tarsus. These are too incomplete to warrant further study at present.

Feather remains (in addition to the type of *Fontinalis pristina*) appear fairly numerous, as there are five slabs bearing impressions of this character in the palaeontological collections in the U. S. N. M. Some of these, together with some additional fossil feathers in the same deposits, received from Prof. T. D. A. Cockerell, have been described and figured (but not named) by Dr. R. W. Shufeldt (Journ. geol., 1913, 21, p. 631-634, 2 figs.).

DESCRIPTION OF PALAEOSPIZA BELLA.

Dr. Allen in his original description says that *Palaeospiza* represents "a high ornithic type, probably referable to the Oscine division of the Passeres. . . . The absence of the bill renders it impossible to assign the species to any particular family, but the fossil on the whole gives the impression of Fringilline affinities." The species has been carried in the list of fossil birds in the A. O. U. Check-List (third edition, 1910, p. 392) as a questionable member of the Fringillidae, and has usually been considered a finch, in part because of the derivation and form of the generic name.

On the same plaque as the type is mounted an impression of the end of a wing and the tip of a tail of a bird which belongs to another specimen, and has no connection with *Palaeospiza*. This represents the distal end of the primaries of a bird with a broad, rounded wing tip, with the shafts of the feathers somewhat curved. The distal end of the rectrices appear to have been graduated with strong heavy shafts. The general impression is that these are similar to the wing and tail of a woodpecker, or a dendrocolaptid, but it is of course, impossible to determine their actual affinity.

As has been stated the type of *Palaeospiza bella* consists of a more or less complete bird, which has been flattened by pressure. The slab in which it is preserved has been split and separated, so that two silhouettes are presented (Plates 1-4), with part of the bones of the fossil adherent in one, and a part in the other. The impression given is that the bird originally lay on its breast, with wings folded at the sides

and feet and neck extended. The fossil is preserved as a thin plate impressed on two slabs of grayish stone which, with the fossil itself is soft and friable. In fact, parts of the plate with several fragments of bones have been lost. As the bird is now mounted, the left-hand portion is impressed and the right-hand one elevated and rounded. In color, the bones are dull, yellowish brown, while the feather impressions are blackish. Certain rounded masses, dull brownish in color, in the thoracic region and near parts of the humeri may represent the fossilized remains of dried flesh.

The drawing, executed by Mr. J. H. Blake, that accompanied the original description, is excellent in its fidelity to outline, proportion, conformation and position of parts, but has the detail of the feathers and various parts considerably exaggerated, as the fossil is much less sharply defined and distinct than one might suppose from studying the original cut.

Skull.—The cast containing the anterior portion of the head has been broken away and lost at the line of the pars plana, or perhaps just behind that point. The remaining impression of the skull is present only on the left-hand slab, as on the opposite plate of stone the fossil has been chipped off in an irregular line that passes through the level of the shoulders. On this right-hand slab, however, there is a faint depression in the matrix that outlines the former resting place of the head. In this impression may be traced an indistinct line that indicates a cranium and a forehead that slopes down to a faintly indicated bill, that may or may not have been flattened. It is unfortunate that the actual bone is not present as it would afford important characters.

On the left-hand slab, where the fossil remains, the outline of the cranium is seen to be low and flattened with a low, sloping forehead. A somewhat triangular impression above, that corresponds to the high, distorted concavity of the opposite slabs, represents former feathers or skin; it leads to conjecture regarding a possible crest. The upper and lower outlines of the cranium are marked by broken bits of bone that scribe a distinct but irregular line. Angular impressions in the lower anterior angle of the orbit may indicate sclerotic plates from the eye, and perhaps remains of palatal or ethmoidal elements. The posterior half of the ramus of the lower jaw is fairly distinct; it appears narrow with indication of a foramen. The processus angularis posterior was prolonged slightly beyond the articulation, and then was obliquely truncated. The external ear opening seems to have been small.

Neck.—The curved line of the cervical vertebrae is distinct, but the

impression is so blurred that individual bones may be made out in only a few cases. The total length is moderate as in most small birds.

Shoulder girdle.—The furculum is short and its fork broad, with a slightly projecting, posterior point at the median symphysis as the only certain indication of a hypocleideum. The coracoid, which is badly crushed, apparently was quite strong, with a considerable expansion at the lower end.

Sternum.—The breast bone is very indistinct. A faint outline within the arms of the furculum may indicate the fork of a strong spina externa. The articular points with the lower end of the coracoid are indicated, a slight projection at the lower end of the bone may represent a part of the carina, and an imperfect plate beside it a fragment of the xiphoid extremity. On this latter part there is indicated a single notch. The region is not well enough preserved to show certainly whether one or two notches were present on either side.

Fore-limb.—Both humeri are present though considerably crushed. They appear strong and heavy, with the crista superior shortened so that it does not extend distally beyond the level of the plate that, on the opposite side, forms the boundary of the fossa subtrochanterica.



FIG. 1.—*Palaospiza bella*.
Anterior view of distal end
of left humerus, $\times 4$.



FIG. 2.—*Palaospiza bella*.
Posterior view of distal
end of right humerus, $\times 4$.

The entire head of the humerus thus appears shortened. The upper end of the shaft is distinctly angled, while the lower portion is rounded as is usual. The ectepicondylar process (Fig. 1) is well developed and is fairly high on the shaft. It is not produced to the extent found in the finches or higher oscines, nor does it seem to be divided at the tip.

Pressure against an underlying bone has forced it backward, but its form is easily evident in spite of this distortion from position. On the opposite side (Fig. 2) the epitrochlea is prominent and is produced distally as a strong process beyond the general level of the outer end of the bone. The ulnar trochlea is narrow but well developed. Its axis is sigmoid, and it extends across to the epitrochlea in a direct line, so that, viewed from above, its distal margin is straight, as in all oscine birds that I have examined. In all the lower Passeriformes, the Eurylaemidae (broad bills), the Mesomyodi (the tracheophones, fly-catchers, cotingas, etc.), and the Pseudoscines (the lyre-bird), the ulnar trochlea has the external margin declivous, sloping down to join the epitrochlea, so that the trochlea projects as a distinct knob. The character seems to be one of importance in separating the higher and the lower Passeriformes.

Above the ulnar trochlea there is evident the depression of the brachialis inferior, with a sharply raised external border, and a flattened surface for the insertion of the pronator brevis and longus. This inner face of the lower end of the humerus is flattened, so that it appears nearly plane.

The radial trochlea is well developed though not large, is slightly concave on its inner face, and at its upper end meets the shaft at an abrupt angle. The intertrochlear sulcus is narrowed.

The ulna is strong, with a fairly prominent olecranal process. Other details are lacking. The radius is well outlined, and, like the ulna, is extraordinarily large and heavy for the size of the bird. The radius, while about as long as the radius in the cedar waxwing, is twice as thick as in that species.

The metacarpus is of the usual passeriform type, with a distinct tuberositas musculis that extends from the second metacarpal across the metacarpal fissure. The tuberculum ulnare appears longer than the tuberculum radiale, but the degree of difference in length between the two may not be made out. The pollex is very faintly indicated. The first phalanx beyond the metacarpal appears relatively shortened, and the second considerably elongated. There is no indication that wing claws were present.

The humerus and the fore-arm are more nearly equal in length than in usual perching birds, as the fore-arm seems only slightly longer than the humerus. The hand too is elongated, and from its indistinct impression appears nearly, and perhaps actually, as long as the fore-arm.

The outstanding features of the wing are the shortened fore-arm,

the elongated distal phalanx of the second digit, and the remarkable strength of radius and ulna.

Ribs.—A few of the posterior ribs show as hair lines below the sternum at one side. Apparently only the sternal segments are preserved.

Pelvis.—The pelvic region is too indistinct to offer details of importance. The sacrum is outlined with some definiteness but is considerably crushed. There is faint presentation of the ilium.

Posterior limb.—The femur, which is shown in outline on the left half of the fossil, seems to have been comparatively long and strong. The outer face, apparently the one presented, was straight as there is no indication of axial flexure. The tibio-tarsus appears of moderate length in comparison with the femur. It was fairly strong, but is so crushed that the terminal processes are only faintly evident. The tarsus seems to have been remarkably small and slender. There is some indication, particularly on the left-hand slab, that the acrotarsium was smooth and was of the acutiplantar form usual in typical oscine birds (except the Alaudidac, where it is latiplantar). No scutellation is actually evident on the anterior face, though there is faint indication that the tarsal sheath of this portion may have been divided. Both tarsi are somewhat broken at the lower end which gives them the appearance of being slightly less in length than is really the case.

The toes, four in number, comparatively long with long, slender claws, are arranged with three projecting toward the front and one behind, in the typical passeriform manner. The third toe, the middle anterior one, is slightly longer than the others, while the second and fourth on either side are apparently about equal in length. The hind toe, while long, is decidedly shorter than the other three.

Feathers.—On one or the other of the halves of the cast wing and tail feathers, with a few on flank, neck, and breast, are represented by a blackish discoloration, that in the case of the larger feathers is lined by impressions made by the heavy shafts. The tail seems to have been broad and perhaps rounded. The two median rectrices project eight millimeters beyond the others; the lateral feathers, clearly visible on the right-hand side, decrease gradually in length toward the outside. The shafts of six feathers are faintly impressed on this right side, indicating a tail of at least twelve rectrices.

The wings are folded in against the body and cannot be seen distinctly. They are long, as in their folded condition the distal end extends well past the base of the tail. It appears that they were of fairly broad area; details of their structure may not be determined.

Measurements.—As most of the bones in *Palacospiza bella* are somewhat crushed, or even broken, lengths of the various parts may be determined only approximately. All measurements given below have been taken carefully by means of dividers.

Length of specimen from point of shoulder to approximate end of pope's nose	66.5 mm.
Length of furculum	14.5 "
" " humerus	23.4 "
Breadth of humerus at distal end	5.5 "
" " shaft of humerus near center	3.0 "
Length of ulna	22.0 "
" " hand	24.5 "
" " metacarpus	12.6 "
" " distal phalanx of second digit	6.0 "
" " femur	18.0 "
" " tibio-tarsus	27.0 "
" " tarso-metatarsus	17.5 "
" " middle toe and claw (measured in two segments)	15.6 "
" " impression of longest rectrix	58.5 "
Approximate length of wing	80.0 "

SYSTEMATIC POSITION.

Allocation of *Palacospiza bella* in our scheme of avian classification is difficult, as the greater part of the head is missing, and the fossil, though handsome to look upon, lacks definite impressions of many of the points used in deciding relationship. It appears that *Palacospiza bella* is not directly related to any of our modern groups, but must stand in a separate category to be known as the family

PALAEOSPIZIDAE.

TYPE.—*Palacospiza bella* Allen.

Diagnosis.—Bones of the wing strong and heavy, with humerus only slightly shorter than fore-arm and hand elongated; head of humerus shortened, distal end with ulnar trochlea not produced as a knob beyond level of epitrochlea (oscinine in form); anterior face of lower end of humerus much flattened; ectepicondylar process relatively high on shaft, distal phalanx of second digit elongated, radius and ulna very strong; tarsus small and slender, toes long, with long slender claws; third toe longest, second and fourth about equal, the first somewhat shorter than the other three.

Relationships.— In its large wings and small feet *Palaeospiza bella* suggests some of the flycatchers or cotingas. It seems particularly to have had very long wings, longer than in the average perching bird. In size it appears about equal to the cedar waxwing (*Bombycilla cedrorum*). The form of the foot, with the general sum of the appearance of the bird, indicate that *Palaeospiza* is a member of the great order of Passeriformes. Further, the form of the ulnar trochlea of the humerus definitely places it in the superfamily Oscines as defined by Ridgway. It is undoubtedly low in position in that group; and it has been indicated that it gives certain suggestions of approach to some members of the superfamily Mesomyodi.

The family Palaeospizidae, therefore, may be placed in the Oscines immediately above the Alaudidae, which family in form of the tarsus differs from all other Passeriformes, and is located at the base of the oscinine group. *Palaeospiza* has no direct relationship to the larks, but rather occupies a somewhat connecting position between the Mesomyodi and the acutiplantar Oscines.

The Palaeospizidae at present includes a single species, *Palaeospiza bella*.

THE STATUS OF PALAEOSPIZA HATCHERI SHUFELDT.

In connection with a study of *Palaeospiza bella* Allen it has been necessary to examine a second fossil, one named by Dr. Shufeldt (Bull. Amer. mus. nat. hist., 4 August, 1913, 32, p. 301, pl. 55, fig. 28) *Palaeospiza hatcheri*, secured near Long Island, Kansas, from beds of doubtful position sometimes called lower Pliocene, but at present usually considered Miocene. In the original description this form was characterized as follows:— "This is the superior mandible of a small finch . . . and it would be difficult to distinguish the same from the same part of the skull in many a small existing species of that group, the size of a *Junco* for example, or a *Spinus*. The species may, quite possibly, still be in existence or its genus may; in any event, this material is not sufficiently extensive for a scientific reference. I have not seen the material upon which Allen based his *Palaeospiza* from the Amyzon Shales of Colorado (Eocene?). Should it be found to belong in that genus, it may, for the sake of designation and record, be subsequently known as *P. hatcheri* for its discoverer. . . ."

The type of *Palaeospiza hatcheri* (U. S. N. M. Cat. 6,647) is an entire upper mandible forward of its junctions with the frontal and the anterior end of the jugals (Fig. 3, 4). It was secured with broken

fragments of other small vertebrates by J. B. Hatcher in 1884. It requires but a glance to determine that this specimen comes from a typical finch (*Fringillidae*), and as such has only remote connection with the type of the genus *Palaeospiza*. Though imperfect, the type of *hatcheri* is sufficiently complete to exhibit pertinent characters. On careful comparison it is found to differ so from modern finches as to necessitate the erection for it of a distinct group which may be called

PALAEOSTRUTHUS, gen. nov.

Characters.—Similar to *Pipilo Vieillot* (*Analyse*, 1816, p. 32. *Type*.—*Fringilla erythrophthalma* Linné), but premaxilla more acute at point, lateral margins more concave; nasal process of premaxilla of uniform width throughout, not expanding in anterior half toward its union with premaxilla; maxilla not produced posteriorly behind union with maxillary process of nasal; maxillary process of nasal not decidedly expanded at lower end where it joins maxilla.

Type.—*Palaeospiza hatcheri* Shufeldt, which will now stand as *Palaeostruthus hatcheri* (Shufeldt).



FIG. 3. — *Palaeostruthus hatcheri*. Type. Dorsal view, $\times 2$.



FIG. 4. — *Palaeostruthus hatcheri*. Lateral view, $\times 2$.

REMARKS.

Somewhat extended comparisons of *Palaeostruthus hatcheri* with skulls of a large number of species of finches from the New and Old Worlds have placed it in the supergeneric group termed by Ridgway the *Zonotrichiae*, a group that contains the towhees, juncos, white-throats, song sparrows, chipping sparrows, and the host of allied species that today comprise a majority of our native sparrows.

In outline the premaxilla of *hatcheri* is very near to *Ammodramus savannarum*, as it has the same acute point, concavity of the lateral

margins, and pronounced posterior broadening of that species. The arrangement of the maxillary in *Palaeostruthus* is, however, distinctly different, and places it in another group. It seems allied to *Pipilo*, particularly to the forms in which the males are largely black and white differing from these in the points outlined in the diagnosis. In size *Palaeostruthus hatcheri* is smaller as it seems to have the approximate dimensions of the green-tailed towhee, *Oberholseria chlorura*.

It will stand in the Zonotrichiae adjacent to the genus *Pipilo*.

Following are pertinent measurements of the type of *Palaeostruthus hatcheri*:—

Total length from tip of premaxilla to posterior margin of nasal opening	10.0 mm.
Greatest breadth through maxillae	6.3 "
Greatest horizontal depth from bridge of culmen to maxilla	3.5 "
Length of external narial opening	4.0 "
Depth of external narial opening	2.0 "